

EXHIBIT “H” STS SPEC

**Solid State Automatic Transfer Switch (STS)
Equipment Specification (STS SPEC)**

**Performance Goals
and
Operating Characteristics**

Version 3

September 5, 2012

SECTION-J, ATTACHMENT J.1 SOLID STATE AUTOMATIC TRANSFER SWITCH (STS) EQUIPMENT SPECIFICATION

1.0 GENERAL

1.1 Summary. These specifications describe -the electrical and mechanical requirements for a Solid State Static Automatic Transfer Switch (STS) herein referred to as a static switch or STS. The specified unit shall be designed, manufactured and tested to this specification. The specified unit shall be designed and tested for all mechanical and electrical characteristics specified in this document. The specified unit shall include all operation, annunciation, detection and switching characteristics specified in this document. The STS units shall be designed to provide operational and annunciation characteristics as specified in this document.

1.2 STANDARDS. The STS units shall be designed, manufactured, tested. and installed in compliance with the following standards:

Safety: Underwriters' Laboratories (UL) , 1008, 1778,
Electrical: National Electrical Manufacturers Association (NEMA) ICS 10,
ANSI C62.41E,
FAA-G-2100F,
NEC Code 1996,
FAA standards 19 and 20 FAA-C-1217,
FAA-STD-032,
Software: ANSI, IEEE
EMC: FCC part 15 subpart J class A,

1.3 ENVIRONMENT REQUIREMENTS

1.3.1 Storage Temperature. Storage Temperature range shall be -40°C to + 70°C

1.3.2 Operating Temperature. Operating temperature range shall be 0°C to 40°C (32°F to 104°F) for cabinet operation and 0° to 45°C (32° to 113°F) for panel operation.

1.3.3 Relative Humidity. Operation shall be reliable in an environment with 0% to 95% non-condensing relative humidity.

1.3.4 Operating Altitude. The unit shall be capable of operation in altitudes up to 10,000 feet above sea level.

1.3.5 Audible Noise. The unit shall not generate audible noise greater than 55 dB outside a radius of 6 feet from the unit during normal operation and while no alarms are being annunciated by the unit.

1.3.6 Magnetic Fields. No appreciable magnetic fields shall be generated. Unit shall be capable of being use directly in computer rooms in any location without danger to data storage systems or devices.

1.3.7 Seismic. The STS units shall be rated for installation in a Seismic Zone 4.

1.4 LIFE EXPECTANCY TESTING.

The sum total of all parts of the specified unit (excluding cooling fans) must be included to determine the mean time between failure of the static switch. This includes the static switch neutrals in 4-pole switches (cannot be mechanically switched). The mean time between failure must be greater than 300,000 hours of continuous operation without failure within the voltage and load conditions specified in this document for the operation of the static switch.

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2.0 PRODUCT

2.1 General Requirements for all Solid State Automatic Transfer Switch (STS).

2.1.1 Switch Logic Operation

2.1.1.1 Input Selection. The static switch shall allow the selection of either Source 1 or Source 2 as the preferred source. The switch shall always default to the preferred source when it is desirable in accordance with Information technology Industry (ITI) – Computer & Business Equipment Manufacturer's Association CBEMA. The alternate source will be selected if the preferred source is undesirable or unusable and the alternate source is desirable. The switch shall always select the best source when the preferred source is classified as not desirable or unusable. When both sources are desirable, the preferred source is always selected.

2.1.1.2 Voltage Sensing. The specified unit shall detect undervoltage and overvoltage conditions, maintain the connection between a viable voltage source and the critical load, and if necessary, transfer uninterruptedly to a separate power source. Each of these functions shall be defined in the static switch by voltage level and timing setpoints. The setpoints shall be adjusted to insure that all critical loads are operated within the safe voltage regions graphically depicted by the ITI-(CBEMA) curve. This is the accepted industry standard for American made power supplies for computerized equipment and is the accepted guideline for FAA equipment in accordance with FAA standards and orders.

2.1.1.3 Voltage Sensing and Transfer Time. The specified unit shall detect ITI-CBEMA defined undervoltage and overvoltage conditions and transfer to an available and desirable source within the allowable region of operation as defined by the ITI-(CBEMA) curve. The instantaneous rate of change of voltage as a function of time (dv/dt) / (t) as described by the ITI-(CBEMA) curve shall be utilized as the testing criteria for fast and slow changing voltage detection. The specified device shall respond in a time period described as follows. The time period shall be a period of time such that the detection time plus the transfer time shall be less than the safe boundary time of the ITI-CBEMA curve. The safe boundary time of the ITI-CBEMA curve is all points on the ITI-CBEMA curve defining the maximum time versus voltage boundary for all acceptable regions of operation below 3 seconds. The total transfer time for the static switch, including fault sensing and transition to a desirable source shall be less than 1/4 cycle (4.175 millisecond) for the loss of primary source.

2.1.1.4 Current Sensing. The specified unit shall detect overcurrent (phase faults), shorted and open static switch conditions on all 3 phases and neutral for both source 1 and source 2 switches.

2.1.1.5 Phase Faults. The specified unit shall not transfer a detected overload to another source. The static switch must be able to detect overcurrent, determine that it is a load fault, and stay on the same source until the fault is cleared by properly coordinated devices downstream of the static switch.

2.1.1.6 Phase and Neutral Transfer Requirements. The specified unit shall transfer 3 phases and the neutral from one source to the three phases and the neutral of the other source for the critical loads. The specified unit shall switch all phase and neutral inputs through solid state devices only to the critical loads. The specified unit shall switch in the following order: 1-failed phases off, 2-new neutral on, 3-new phases on, 4- failed neutral off. No mechanical switching (which causes arcing if used in phase or neutral switching) shall be used. The switch shall be transfer tested to verify there is no generation of transients.

2.1.1.7 Measurement, Decision, and Action Circuitry. The specified unit shall utilize noise immune and direct measurement operational amplifier and digital logic switching for both the decision making and transfer command process. This technology is similar to the static switch utilized in the ACEPS

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bypass transfer and control logic and has proven to be very reliable. Fetch and execute routines may not be utilized to gather, store or compare real time voltage and current data or to transfer critical information (that could be flawed by noise induced even bit errors) while the switch is operationally protecting the critical loads. Fetch/Execute operations are not acceptable in the decision making process to transfer and are not acceptable in the initiation of the transfer process. The logic shall be designed to make direct measurements of voltage and current values from all sources and make direct comparisons of all critical parameters against pre-adjusted and calculated ITI or CBEMA curve acceptable set-points. The comparison technique of the measured variable verses the set point may be digital, analog or a combination of digital and analog logic. The comparison technique shall not require a fetch execute routine to load the value of the measured variable or to load the value of the set point.

2.1.1.8 Set Point Accessibility. All voltage, current, and timing set-point adjustments shall not be accessible from the operator's panel of the static switch. The key switch shall enable only front panel controls and shall not enable adjustment of any operational set-point for either detection or transfer functions. The set-point adjustments shall only be accessible by a plug-in enabling device that can be removed from the switch during normal operation. The plug-in device shall require the entry of a password to gain access to the static switch set-point adjustments.

2.1.1.9 ADJUSTMENTS. The specified unit shall incorporate the following adjustments. Refer to 2.1.1.8 to determine the accessibility requirements to perform the adjustments for the static switch.

2.1.1.9.1 Phase Angle Difference. This adjustment shall allow the switch to transfer over a range of zero to 35 degrees of the sine wave phase difference between the preferred and the alternate sources. It shall be adjusted to allow a transfer between zero and 15 degree's phase displacement.

2.1.1.9.2 Overvoltage This adjustment shall allow the switch to detect and transfer on an overvoltage threshold that is adjustable from 105% to 120% of the nominal line voltage. It shall be adjusted to 110% of the nominal line voltage.

2.1.1.9.3 Undervoltage (Below the Desired Value) This adjustment shall allow the switch to detect the first level of undervoltage over a window ranging from -5% to -25% of the nominal voltage. For a 208 volt switch this window ranges from 114/198 volts down to 90/156 volts. The setting shall be adjusted to 108/187 volt's AC rms. For a 277/480 volt switch, this window ranges from 264/456 volts down to 208/360 volts. The setting shall be adjusted to 250/432 volts rms.

2.1.1.9.4 Undervoltage (Below the usable value) This adjustment shall allow the switch to detect the second level of undervoltage over a window ranging from -20% to -32% of the nominal range. For a 120/208 volt switch this window ranges from 96/167 volts down to 82/142 volts. The setting shall be adjusted to 84/146 volts rms. For a 277/480 volt switch, this window ranges from 222/384 volts down to 189/327 volts. The setting shall be adjusted to 159/336 volts rms

2.1.1.9.5 Overload for Source. This adjustment shall allow the switch to detect and annunciate an overload condition for the switch over a window from 100-125% of the nominal amperage. For a 150 amp switch it shall be adjustable over the range of 150 amps to 188 amps load current. The setting shall be adjusted to 173 amps rms current. For a 250 amp switch it shall be adjustable over the range of 250 amps to 313 amps load current. The setting shall be adjusted to 288 amps rms current. For a 400 amp switch it shall be adjustable over the range of 400 amps to 500 amps load current. The setting shall be adjusted to 460 amps rms current. For a 600 amp switch it shall be adjustable over the range of 600 amps to 750 amps load current. The setting shall be adjusted to 690 amps rms current.

2.1.1.9.6 Overload (Failed /Shorted Load). This adjustment shall allow the switch to detect a load fault and inhibit the transfer until the fault clears over a window from 150%-275% of nominal amperage. For a 150 amp switch it shall be adjustable over the range of 225 amps to 413 amps load current. The

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setting shall be adjusted to the normal load current of 150 plus 380 amps for a total of 530 amps. For a 250 amp switch it shall be adjustable over the range of 375 amps to 688 amps load current. The setting shall be adjusted to the normal load current of 250 plus 633 amps for a total of 883 amps. For a 400 amp switch it shall be adjustable over the range of 600 amps to 1100 amps load current. The setting shall be adjusted to the normal load current of 400 plus 1012 amps for a total of 1412 amps. For a 600 amp switch it shall be adjustable over the range of 900 amps to 1650 amps load current. The setting shall be adjusted to the normal load current of 600 amps plus 1518 amps for a total of 2118 amps.

2.1.1.9.7 Frequency Detection. This shall be fixed over a window of 57 to 63 Hertz in accordance with the input frequency allowable for the Air Route Traffic Control Center Critical and Essential Power Supply (ACEPS) Uninterruptible Power Supplies (UPS). This could be present when on E/G's and on bypass operation.

2.1.1.9.8 Re-Transfer Time. This adjustment shall allow the switch to delay re-transfer to the preferred source until the source has had sufficient time to settle. It shall allow the facility to stagger static switch load re-transfer times. It shall have an adjustment range to 3600 seconds. It shall be set to stagger the load re-transfers at 15 second intervals.

2.1.1.9.9 Out of Phase Transfer Delay. This adjustment shall allow the switch to delay transfer out of phase transfers. Out of phase transfers shall only occur if the source on load is unusable. The delay shall be set to 16.67 milliseconds (1 cycle of the 60 Hertz).

2.1.2 Controls. The specified unit shall have the following controls:

2.1.2.1 Lamp Test. This control shall be designed to illuminate all indicator LED's and/or lamps. This control shall operate all segments of all dual color indicators used to observe functional status.

2.1.2.2 Reset Fault Control. This control shall be designed to reset latched overloads that have latched the switch onto the original source to clear downstream faults.

2.1.2.3 Source Selector for Source #1. This control shall be designed to select Source #1 as the preferred source for the critical loads.

2.1.2.4 Source Selector for Source #2. This control shall be designed to select Source #2 as the preferred source for the critical loads.

2.1.2.5 Auto Retransfer Selector Switch. This control shall be designed to allow the operator the option of selecting automatic retransfer when the preferred source is normal or to prevent automatic retransfer and remain on the alternate source any time a transfer takes place and the alternate source remains normal.

2.1.2.6 Control Enable Key Switch. The specified unit shall have a key switch designed to lock out all control functions except lamp test. Only when the key switch is enabled may one perform source select functions, retransfer mode selection, and alarm clear/reset functions.

2.1.2.7 Reset (Main or Master). This reset functional control shall be located away from the normal access of the front panel. It shall be located internally in the switch. It shall provide a power on type of reset and an all alarm reset.

2.1.2.8 Alarm Silence Switch. This switch shall silence the audible alarm but shall not reset any alarm or indication.

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2.1.3 INDICATORS

2.1.3.1 Indicator Functions

2.1.3.1.1 Switch not OK. (Red Indicator prominent in the display area.) This indicator shall illuminate when any alarm is detected.

2.1.3.1.2 Availability of Source #1 Input. This is a multifunction indicator/s. This indicator/s shall illuminate and delineate the conditions of Source #1 being 1. Good, 2. Not desirable, or 3. Not useable. This indicator/s shall flash indicating that the switch will not transfer to this source due to a logic inhibit such as an overload on the power source being utilized at this moment.

2.1.3.1.3 Availability of Source #2 Input. This is a multifunction indicator/s. This indicator/s shall illuminate and delineate the conditions of Source #2 being 1. Good, 2. Not desirable, or 2. Not useable. This indicator/s shall flash indicating that the switch will not transfer to this source due to a logic inhibit such as an overload on the power source being utilized at this moment.

2.1.3.1.4 Load on Source #1. This indicator shall indicate that Source #1 is supplying load power.

2.1.3.1.5 Load on Source #2. This indicator shall indicate that Source #2 is supplying load power.

2.1.3.1.6 Source #1 is Preferred. This indicator shall indicate that Source #1 has been selected as the preferred source and the system will default to this source when it is normal and the switch is allowed to retransfer.

2.1.3.1.7 Source #2 is Preferred. This indicator shall indicate that Source #2 has been selected as the preferred source and the system will default to this source when it is normal and the switch is allowed to retransfer.

2.1.3.1.8 Retransfer Enabled Indicator. This indicator shall indicate that the automatic retransfer mode has been selected and the switch will return to the preferred source automatically.

2.1.3.1.9 Retransfer Enabled Off Indicator. This indicator shall indicate that the automatic retransfer mode has been deselected and the switch will remain on the alternate source until manually transferred.

2.1.3.1.10 Critical Load Powered Up. This indicator shall indicate that either Source #1 or Source #2 static switch is on to provide a path for the power to reach the critical load.

2.1.3.2 Indicator Conditional Response. Indicators shall indicate either individually or in combination each of the following conditions:

2.1.3.2.1 Source #1 Conditions Annunciated. The indicators shall indicate that Source #1's frequency is to high or to low; Source #1 has a Blown Fuse, Source #1's under voltage condition makes it not usable, Source #1's voltage is low and acceptable but not desirable, Source #1's voltage is to high to use, Source #1 is Overloaded, Source #2 has a device (SCR or IGBT, etc.) open, Source #1 has a Shorted device (SCR or IGBT, etc.) open, and Source #1's input breaker is open.

2.1.3.2.2 Source Two Conditions Annunciated. The indicators shall indicate that Source #2's frequency is to high or to low. Source #2 has a Blown Fuse, Source #2's under voltage condition makes it not usable, Source #2 voltage is low and acceptable but not desirable, Source #2's voltage is to high

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to use, Source #2 is Overloaded, Source #2 has a device (SCR or IGBT, etc.,) open, Source #2 has a Shorted device (SCR or IGBT, etc.,) open, and Source #2's input breaker is open.

2.1.3.2.3 System Conditions Annunciated. The indicators shall indicate an over Temperature condition of any device (SCR or IGBT, etc.,), the logic cabinet, indicate when any fan fails, and indicate when an external transfer inhibit command is active while on either source and when either Source #1 or source #2 is on bypass.

2.1.4 COMMUNICATIONS

2.1.4.1 Serial Port. The Static Switch shall have one RS485 compatible communication port that requires no hardware protocol. The baud rate shall be 9600, the data shall be 8 bits with no parity, there shall be one start bit and one stop bit. The communication line shall be 120 ohms at each end and shall have a six position, four wire modular phone jack provided for easy access.

2.1.4.2 Serial Port Setup Control. The static switch shall be setup or adjusted via the serial port through the serial port phone jack utilizing a personal computer based program to communicate with the static switch. It shall be accessed with a security password only.

2.1.4.3 Auxiliary Contacts. The static switch shall provide interface provisions for mating with the optional enclosure or field wiring to monitor status of the input isolation devices: The static switch shall annunciate the following contacts:

1. Source #1 - Input is isolated or input isolation breaker is OPEN.
2. Source #2 - Input is isolated or input isolation breaker is OPEN.

2.1.4.3.1 Shunt Trip Capability. The Static Switch shall be designed to provide shunt trip contacts rated for 120 VAC, one amp, for both source 1 and source 2 input circuit breaker shunt trip coils. The static switch shunt trip circuit shall provide interface provisions to tie to the wiring in the optional enclosure or to connect to existing field wiring. The shunt trip circuit shall activate under either of the following conditions:

1. A shorted (SCR or IGBT, etc.,) device on one source shall shunt trip the other source input breaker.
2. A shorted (SCR or IGBT, etc.,) on a unusable source.

2.1.5 COOLING REQUIREMENTS

2.1.5.1 Cooling Media. Static Transfer Switch cooling is by ambient air using mechanical means or convection.

2.1.5.2 Fans. All fans used shall be manufactured using ball bearing and must be replaceable with front access without shutting down the switch. Fan life must be 40,000 hour's minimum.

2.1.5.3 Filters. All filters shall be accessible from the front panel and shall be replaceable without shutting down the switch. Filters shall meet Federal Specification A-A-1419 or MIL-F-16552 if velocity exceeds 300 FPM.

2.1.5.4 Over Temperature Detection. The static switch must have over temperature detection in each device (SCR or IGBT, etc.,) heat sink to protect all phase switching devices and all neutral switching devices.

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2.1.5.5 Convection Cooling. STS cooling by free flow of ambient air, without the aid of mechanical means, as permitted by the enclosure design.

2.1.6 ADDITIONAL FEATURE REQUIRED

2.1.6.1 Redundant Logic Power Supplies. The switch shall have dual logic power supplies powered by both source 1 and source 2. The power supplies shall be configured with component isolation so that either supply can operate the logic and device (SCR or IGBT, etc.,) drive circuits as a stand alone supply and can take over the task without interruption if the other source or source power supply fails. Either failed supply shall be annunciated in the alarm circuitry.

2.1.6.2 Power Failure Log. A log that can be computer accessed through the serial port shall record all outages, transfer operations, and any switch alarm including date and time of the event. The switch shall maintain the power failure log in a nonvolatile memory (preferred) or by rechargeable battery backup for a minimum of 7 days without power.

2.1.6.3 SCR characteristics. Device (SCR or IGBT, etc.,) data shall be used to enhance the transfer process through gate timing. The manufacturer shall use the device "off" curves to determine the time that the charge is stored on the gated off device to time the gating process; thereby minimizing the possibility of shoe-through. The manufacturer shall utilize Devices with charge (Q) discharge characteristic time such that the sum of the discharge time plus the gating on time shall be less than 500 microseconds.

2.1.6.4 Positive Logic Indicators. All LED and lighting indicators shall illuminate when the condition annunciated is true. The manufacturer shall not utilize negative logic to circumvent any required annunciation requirement in this specification.

2.1.6.5 Accessible and Ample Test Points. All circuit boards shall be fully illustrated in the manufacture's service manual and all function's annunciated must have board accessible test points and indicators for comprehensive static switch troubleshooting.

2.2 STATIC TRANSFER SWITCH ELECTRICAL AND PHYSICAL REQUIREMENTS

The Static Transfer Switch (STS) has a requirement for 208 volt and 480 volt switches in amperages of 150, 250, 400 and 600 Amps. The 208 volt STS are needed in two distinctly different physical configurations and option of 3 or 4-Pole switching.

2.2.1 Air Route Traffic Control Center (ARTCC) Static Transfer Switch (STS), 208 Volt, 4-pole, 150 Amp, Without Bypass Cabinet, ASCO Enclosure Compatibility.

2.2.1.1 Physical Requirements.

2.2.1.1.1 Mechanical Compatibility Without Bypass Cabinet. The ARTCC STS unit, without Bypass Cabinet, shall be designed to be installed to meet the required enclosure measurements and requirements for the ASCO model 940 automatic transfer switch. The ARTCC STS unit is a replacement for the existing mechanical transfer switch and must be manufactured to comply with the ARTCC space and installation requirements for ARTCC locations.

2.2.1.1.2 Mechanical Configuration Requirements

2.2.1.1.2.1 Service Access. Service Access shall be from the front only.

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2.2.1.1.2.2 Cable Entry. Cable entry shall be inside the existing ASCO 940 enclosure, and utilize the existing wiring installed into the ASCO 940, which is currently configured with 350 amp Anderson connectors..

2.2.1.1.2.3 Air Intake. Air intake shall be at the front and air shall be exhausted at the front.

2.2.1.1.2.4 Lift and Handle. Lifting and Handling Lifting and handling devices shall be installed on the front of the switch. Removable rods or slides shall be incorporated into the design to allow the switch to be slid forward out of the existing ASCO enclosure and the Anderson termination's (or equal) to be disconnected. So that the switch then can be lifted and removed

2.2.1.1.2.5 Mean-Time-to-Repair. The design shall be such that the switch can be replaced in a 30 minute or less by trained FAA technical personnel.

2.2.1.1.2.5.1 Mounting and Dimensions. The Bulk of the switch shall be contained within the space limited by the physical size of the ASCO 940 (flush mounted 18 inches wide by 32 inches high by 12 inches deep) and shall be restricted by the existing vertical and horizontal rows of ASCO switches installed at existing ARTCC sites. The static switch shall be confined to the space limitations of multiple switch installations. A variance can be authorized to the depth dimension of 12 inches not to exceed 18 inches total, to allow for conductor/connection clearance.

2.2.1.1.2.6 Finish. The front cover shall be brushed stainless steel and finished per FAAG-2100F, paragraph 3.3.1.2.6.3.

2.2.1.2 Electrical Requirements

2.2.1.2.1 Inputs

2.2.1.2.1.1 Input Voltage. The nominal input voltage shall be three phase, 120/208 volt's ac \pm 10%.

2.2.1.2.1.2 Input Voltage Operating Range. The 120/208 volt unit shall be able to operate normally utilizing the input voltage over a range of 82/142 to 144/250 volt's ac rms.

2.2.1.2.1.3 Input Voltage Connection. The input voltage shall be connected three phase and four wire.

2.2.1.2.1.4 Neutral Plate Connection. The input neutral shall be manufactured with a continuous rated ampacity of 200 percent of line current.

2.2.1.2.1.5 Frequency. The unit shall be designed to operate normally over a frequency range of 57 to 63 Hertz.

2.2.1.2.1.6 Termination. The input connectors for source 1 and source 2 shall be 350A Anderson connectors or equal (of appropriate gender) attached to 40 inch pigtails. Opposite gender Anderson connectors or equal shall be provided for installation to the existing wiring or to new wiring in new installations.

2.2.1.2.1.7 Input Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the 150 amp rating (200 percent of line current) for the switch with a minimum of 600 volt root mean square (rms) ac voltage rating).

2.2.1.2.2 Outputs

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2.2.1.2.2.1 Output Voltage. The output voltage shall be no more than 4 volts rms below the selected source.

2.2.1.2.2.2 Output Current. The output current rating shall be no less than 150 amps rms continuous.

2.2.1.2.2.3 Overload Capacity. The device shall be capable of providing overload current to the load under the following conditions:

- 125 % of rated load capacity for 5 minutes
- 300 % of rated load capacity for 20 seconds
- 330 % of rated load capacity for 15 seconds
- 360 % of rated load capacity for 10 seconds

2.2.1.2.2.4 Inrush. The device shall be capable of withstanding 1200% current for 8.33 milliseconds.

2.2.1.2.2.5 Fault Clearing. The device shall be capable of withstanding 22,000 amps symmetrical fault current.

2.2.1.2.2.6 Voltage Withstand. The device shall be capable of withstanding 2000 volt transients as specified by ANSI C 62.41B.

2.2.1.2.2.7 Termination. The output connectors for the static switch shall be 350A Anderson connectors or equal (appropriate gender) attached to 40 inch pigtails. Opposite gender Anderson connectors or equal shall be provided for installation to the existing wiring or to new wiring in new installations.

2.2.1.2.2.8 Output Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the 150 amp rating (200 percent line current) for the switch with a minimum of 600 volt rms. AC voltage rating. All bus work and interconnecting cables shall be made of copper. Aluminum is not acceptable (except for the semiconductor heat sinks).

2.2.1.2.2.9 Performance. The unit shall perform at 98% efficiency. Defined as ratio of output power to input power.

2.2.2 Air Route Traffic Control Center (ARTCC) Static Transfer Switch (STS), 208 Volt, 4-pole, 150 Amp, With Bypass Cabinet, STS Unit is ASCO Enclosure Compatible.

2.2.2.1 Physical Requirements.

2.2.2.1.1 Mechanical Compatibility of Static Switch. This Static Transfer Switch unit assembly is identical to the STS unit in paragraph 2.2.1 above, except it is placed in a removable enclosure which is bolted on the front top of a NEMA 1 stand alone main enclosure containing bypass capability. This main enclosure shall consist of a manually operated Maintenance Bypass Switching and Isolating Arrangement consisting of molded case switches to permit transferring the loads to either source and to isolate the Static Transfer Switch Assembly for servicing without disrupting power to the critical load. .

2.2.2.1.2 Mechanical Configuration Requirements

2.2.2.1.2.1 Service Access. Service Access for the switch assembly mounted on the top portion of the stand alone bypass enclosure shall be from the front only. Service access for the lower portion of the stand alone bypass enclosure shall be from the front and at least one of the sides or rear of the bypass cabinet.

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2.2.2.1.2.2 Cable Entry. Cable entry to the switch unit assembly housed in an enclosure atop the main stand alone bypass enclosure shall be from the inside and between these two enclosures.

2.2.2.1.2.3 Air Intake. Air intake shall be at the front and air shall be exhausted at the front.

2.2.2.1.2.4 Lift and Handle. Lifting and Handling Lifting and handling devices shall be installed on the front of the switch. Removable rods or slides shall be incorporated into the design to allow the switch to be slid forward out of the free standing cabinet enclosure, use of Anderson termination's (or equal) to facilitate disconnection, so that the switch then can be lifted and removed.

2.2.2.1.2.5 Mean-Time-to-Repair. The design shall be such that the switch can be replaced in 30 minutes or less by trained FAA technical personnel.

2.2.2.1.2.5.1 Mounting and Dimensions. The switch shall be placed in a removable enclosure which is bolted on the front top of a NEMA 1 stand alone main enclosure containing bypass capability (see Paragraph 2.2.2.3 below).

2.2.2.1.2.6 Finish. The front cover shall be brushed stainless steel and finished per FAAG-2100F, paragraph 3.3.1.2.6.3.

2.2.2.2 Electrical Requirements

See Paragraph 2.2.1.2 above for electrical requirements.

2.2.2.3 Free Standing Bypass Cabinet. This is a NEMA Type 1 enclosure for housing the ARTCC STS unit and the Bypass capability. The ARTCC STS unit enclosure opening and mounting frame shall be similar to the ASCO 940 enclosure so that it will fit into the upper portion housing of the free standing enclosure. The enclosure shall also house the manual ARTCC STS bypass molded case switches in the bottom portion of the enclosure and the mimic board on the front face of the cabinet. The overall enclosure is free standing with maximum dimensions of: Height 81-inches x Width 22-inches x Depth 23-inches. The ARTCC STS unit is mounted in the top portion of the free standing bypass cabinet and the bypass molded case switches are accessible in the bottom portion, with the mimic board on the front face of the cabinet.

2.2.3 Static Transfer Switch (STS), 208 Volt, 3-pole, 150 Amp, 250 Amp, 400 Amp, 600 Amp, with Bypass Cabinet, Free Standing.

2.2.3.1 Free Standing Cabinet Physical Requirements.

2.2.3.1.1 Static Transfer Switch with Integral Bypass Cabinet. The STS cabinet shall be free standing with capability of mounting the cabinet back against a wall. The entire enclosure housing the STS, manual bypass, and display screen maximum dimensions are:

Height 87-inches x Width 34-inches x Depth 34-inches.

2.2.3.1.2 Mechanical Configuration Requirements

2.2.3.1.2.1 Service Access. Service Access shall be from the front primarily. This will permit installation of the STS enclosure with back panel against a wall. Service access for the lower portion of the STS enclosure shall be from at least one of the sides or rear of the bypass cabinet.

2.2.3.1.2.2 Cable Entry. Cable entry shall be allowed from the top and bottom.

2.2.3.1.2.3 Cooling: See paragraph 2.1.5 above.

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2.2.3.1.2.4 Mean-Time-to-Repair. The design shall be such that the switch can be repaired in 30 minutes or less by trained FAA technical personnel.

2.2.3.2 Electrical Requirements

2.2.3.2.1 Inputs

2.2.3.2.1.1 Input Voltage. The nominal input voltage shall be three phase 120/208 volt's ac $\pm 10\%$.

2.2.3.2.1.2 Input Voltage Operating Range. The 120/208 volt unit shall be able to operate normally utilizing the input voltage over a range of 82/142 to 144/250 volt's ac rms.

2.2.3.2.1.3 Input Voltage Connection. The input voltage shall be connected three phase and four wire.

2.2.3.2.1.4 Neutral Plate Connection. The input neutral shall be manufactured with a continuous rated ampacity of 200 percent of line current.

2.2.3.2.1.5 Frequency. The unit shall be designed to operate normally over a frequency range of 57 to 63 Hertz.

2.2.3.2.1.6 Input Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the STS amp rating (200 percent of line current) for the switch with a minimum of 600 volt rms ac voltage rating.

2.2.3.2.2 Outputs

2.2.3.2.2.1 Output Voltage. The output voltage shall be no more than 4 volts rms. below the selected source.

2.2.3.2.2.2 Output Current. The output current rating shall be no less than STS amps rms continuous.

2.2.3.2.2.3 Overload Capacity. The device shall be capable of providing overload current to the load under the following conditions:

- 125 % of rated load capacity for 5 minutes
- 300 % of rated load capacity for 20 seconds
- 330 % of rated load capacity for 15 seconds
- 360 % of rated load capacity for 10 seconds

2.2.3.2.2.4 Inrush. The device shall be capable of withstanding 1200% current for 8.33 milliseconds.

2.2.3.2.2.5 Fault Clearing. The device shall be capable of withstanding 22,000 amps symmetrical fault current.

2.2.3.2.2.6 Voltage Withstand. The device shall be capable of withstanding 2000 volt transients as specified by ANSI C 62.41B.

2.2.3.2.2.7 Output Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the STS amp rating (200 percent line current) for the switch with a minimum of 600 volt rms. AC voltage rating. All bus work and interconnecting cables shall be made of copper. Aluminum is not acceptable (except for the semiconductor heat sinks).

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2.2.3.2.2.8 Performance. The unit shall perform at 98% efficiency. Defined as ratio of output power to input power.

2.2.4 Static Transfer Switch (STS), 480 Volt, 3-pole, 150 Amp, 250 Amp, 400 Amp, 600 Amp, with Bypass Cabinet, Free Standing.

2.2.4.1 Free Standing Cabinet Physical Requirements.

2.2.4.1.1 Static Transfer Switch with Integral Bypass Cabinet. The STS cabinet shall be free standing with capability of mounting the cabinet back against a wall. The entire enclosure housing the STS, manual bypass, and display screen maximum dimensions are:
Height 87-inches x Width 34-inches x Depth 34-inches.

2.2.4.1.2 Mechanical Configuration Requirements

2.2.4.1.2.1 Service Access. Service Access shall be from the front primarily. This will permit installation of the STS enclosure with back panel against a wall. Service access for the lower portion of the STS enclosure shall be from at least one of the sides or rear of the bypass cabinet.

2.2.4.1.2.2 Cable Entry. Cable entry shall be allowed from the top and bottom.

2.2.4.1.2.3 Cooling: See paragraph 2.1.5 above.

2.2.4.1.2.4 Mean-Time-to-Repair. The design shall be such that the switch can be repaired in 30 minutes or less by trained FAA technical personnel.

2.2.4.2 Electrical Requirements

2.2.4.2.1 Inputs

2.2.4.2.1.1 Input Voltage. The nominal input voltage shall be three phase, 480 volt ac $\pm 10\%$.

2.2.4.2.1.2 Input Voltage Operating Range.

The 277/480 volt unit shall be able to operate normally utilizing the input voltage over a range of 189/327 to 333/576 volt's ac rms.

2.2.4.2.1.3 Input Voltage Connection. The input voltage shall be connected three phase and four wire.

2.2.4.2.1.4 Neutral Plate Connection. The input neutral shall be manufactured with a continuous rated ampacity of 200 percent of line current.

2.2.4.2.1.5 Frequency. The unit shall be designed to operate normally over a frequency range of 57 to 63 Hertz.

2.2.4.2.1.6 Input Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the STS amp rating (200 percent of line current) for the switch with a minimum of 600 volt route mean square rms) ac voltage rating.

2.2.4.2.2 Outputs

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2.2.4.2.2.1 Output Voltage. The output voltage shall be no more than 4 volts rms below the selected source.

2.2.4.2.2.2 Output Current. The output current rating shall be no less than STS amps rms continuous.

2.2.4.2.2.3 Overload Capacity. The device shall be capable of providing overload current to the load under the following conditions:

- 125 % of rated load capacity for 5 minutes
- 300 % of rated load capacity for 20 seconds
- 330 % of rated load capacity for 15 seconds
- 360 % of rated load capacity for 10 seconds

2.2.4.2.2.4 Inrush. The device shall be capable of withstanding 1200% current for 8.33 milliseconds.

2.2.4.2.2.5 Fault Clearing. The device shall be capable of withstanding 22,000 amps symmetrical fault current.

2.2.4.2.2.6 Voltage Withstand. The device shall be capable of withstanding 2000 volt transients as specified by ANSI C 62.41B.

2.2.4.2.2.7 Output Conductor Ratings Phase conductors and neutral shall be provided with a wire size of at least 125% of the STS amp rating (200 percent line current) for the switch with a minimum of 600 volt rms. AC voltage rating. All bus work and interconnecting cables shall be made of copper. Aluminum is not acceptable (except for the semiconductor heat sinks).

2.2.4.2.2.8 Performance. The unit shall perform at 98% efficiency. Defined as ratio of output power to input power.

3.0 TESTING

3.1 Quality Assurance. The specified unit shall be factory quality assurance tested. After a 24 hour burn-in, all switch detection functions, transfer functions, interlock functions and all annunciation's shall be verified operational. The static switch shall be signed off by a manufacturer's quality assurance officer. The sign off document shall be affixed to the switch stating the full name of the quality assurance officer, the date and time the sign off occurred.